

Appl. No. 10/629,137
Amtd. dated May 22, 2007
Reply to Office Action of March 22, 2007

Docket No. A01181

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REMARKS/ARGUMENTS

MAY 22 2007

Claims 1,2, and 4-8 remain in this application. Claim 3 is canceled, without prejudice. No amendments to the present claims are submitted at this time.

Response to rejection of claims 1,2, and 4-8 over Greenblatt

In the above-identified Office Action the Examiner rejected claims 1,2, and 4-8 under 35 USC §103(a) as being obvious over US 6,063,857 (Greenblatt).

The Examiner states,

"The difference between the claimed invention and that described within the [Greenblatt] patent is that one of ordinary skill would need to select the monomers from the list at column 3 lines 10-38 [of Greenblatt], so as to meet the limitations of i), ii), and iii) [of present claim 1]."

Applicants respectfully disagree. Applicants submit that the scope of Greenblatt's disclosure does not include the polymers recited in present claim 1. Greenblatt discloses a specific class of polymers, and Greenblatt's class of polymers does not include the polymers recited in present claim 1, regardless of the monomers chosen from Greenblatt's list of monomers.

Greenblatt defines his invention as involving "emulsion polymers" (col. 1, lines 10-11). Greenblatt defines his emulsion polymers thus: "The process of this invention requires emulsion polymerizing a mixture of monomers. . ." (col. 2, lines 14-16). Thus, Greenblatt is using the phrase "emulsion polymer" to mean (as it normally does) polymers produced by emulsion polymerization.

The phrase "emulsion polymerization" is well known in the art. The phrase does not merely refer to the physical form "emulsion" but refers to well-known techniques of forming polymers. These techniques all involve free-radical polymerization of vinyl monomers. For example, M. P. Stevens, in his textbook Polymer Chemistry: An Introduction, (Oxford University Press, 1999) (relevant excerpts attached) describes "emulsion polymerization" in section 6.3.4, which is a section of chapter 6, which is titled "Free Radical Polymerization." Chapter 6, in turn, is part of section II, which is titled

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"Vinyl Polymers." In the same textbook, Stevens defines "vinyl polymers" as "all polymers prepared by chain reaction polymerization of alkenyl monomers" (p. 17).

It is well known that vinyl polymers have polymer backbones that consist of carbon-carbon bonds. Stevens' definition, quoted herein above, reinforces this point. Chain reaction polymerization (also known as "free radical polymerization") of alkenyl monomers consists of opening the double bonds of the alkenyl groups to form a polymer backbone of carbon-carbon bonds. Thus, vinyl polymers do not have non-carbon atoms like oxygen or nitrogen in the backbone of the polymer chain.

Applicants note that all the monomers described by Greenblatt at col. 3, lines 10-38 are vinyl monomers. All of these monomers have carbon-carbon double bonds and are intended to participate in free-radical polymerization in the conventional manner.

To summarize the limitations of Greenblatt's disclosed polymers: Greenblatt's polymers are limited to "emulsion polymers," which are polymers made by emulsion polymerization. Emulsion polymerization is a technique can only be used to make vinyl polymers and not to make other types of polymers. Thus the polymers disclosed by Greenblatt are all vinyl polymers. Vinyl polymers have no atoms in the polymer backbone other than carbon atoms, so Greenblatt's polymers do not have atoms other than carbon in the polymer backbone.

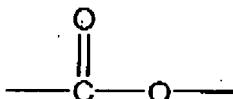
Each of the polymers recited in present claim 1 has a non-carbon atom in the polymer backbone and thus falls outside of the class of polymers taught by Greenblatt.

In present claim 1, item i) is "lignosulfonic acid homopolymers, copolymers, and salts thereof." This item refers to naturally occurring lignin polymers that have had side groups substituted to add a sulfonic acid as a side group on the polymer chain. Lignin polymers have ether linkage (i.e., -O- linking group) in the polymer chain. Because of the ether linkage, lignin polymers are not vinyl polymers and thus fall outside the class of polymers disclosed by Greenblatt. Description of lignin polymers and of sulfonic acid group substitution can be found, for example, in the description by S.E. Lebo, et. al., in "Lignin," in the Encyclopedia of Polymer Science and Technology, John Wiley & Sons, 2002 (relevant excerpts attached).

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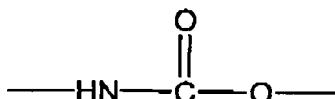
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In present claim 2, item ii) is "anionic polyester homopolymers, copolymers and salts thereof." The meaning of item ii), which is clear to persons of ordinary skill, is that item ii) includes anionic polyester homopolymers, anionic polyester copolymers, salts of anionic polyester homopolymers, and salts of anionic polyester copolymers. All of the polymers recited in item ii) are polyester polymers. Polyester polymers are polymers that contain, in the polymer backbone, the linking group



Thus, polyester polymers have an oxygen atom in the polymer backbone. As discussed herein above, polyester polymers are therefore not vinyl polymers; polyester polymers cannot be made by emulsion polymerization; and therefore polyester polymers fall outside the class of polymers disclosed by Greenblatt.

In present claim 2, item iii) is "anionic polyurethane homopolymers, copolymers and salts thereof." The meaning of item iii), which is clear to persons of ordinary skill, is that item iii) includes anionic polyurethane homopolymers, anionic polyurethane copolymers, salts of anionic polyurethane homopolymers, and salts of anionic polyurethane copolymers. All of the polymers recited in item iii) are polyurethane polymers. Polyurethane polymers are polymers that contain, in the polymer backbone, the linking group



Thus, polyurethane polymers have an oxygen atom and a nitrogen atom in the polymer backbone. As discussed herein above, polyurethane polymers are therefore not vinyl polymers; polyurethane polymers cannot be made by emulsion polymerization; and therefore polyurethane polymers fall outside the class of polymers disclosed by Greenblatt.

In sum, Applicants submit that the polymers recited in Greenblatt do not include the polymers recited in present claim 1. No matter which of Greenblatt's disclosed monomers are chosen, the resulting polymer is, according to Greenblatt's teachings, a

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type of polymer that must be a vinyl polymer. The polymers recited in present claim 1 are not vinyl monomers. Greenblatt makes no teaching or suggestion toward using polymers outside the class of polymers made by emulsion polymerization. Therefore, Applicant submits that present claim 1 is not obvious over Greenblatt.

Conclusion

In view of the foregoing amendments and arguments, Applicants respectfully request the Examiner to enter the amendments, to reexamine the claimed subject matter, to withdraw the rejections of the claimed subject matter, and to allow claims 1, 2, and 4-8 at this time. If, however, there remain any open issues which the Examiner believes can be resolved by a telephone call, the Examiner is cordially invited to contact the undersigned agent.

No fees are believed to be due in connection with the submission of this amendment; however, if any such fees, including petition or extension fees, are due, the Commissioner is hereby authorized to charge them, as well as to credit any overpayments, to Deposit Account No. 18-1850.

Respectfully Submitted,

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Date: May 22, 2007

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Attachment #1: Excerpts from M.P. Stevens, Polymer Chemistry: An Introduction, third Edition, Oxford University Press, 1999.

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Free Radical Polymerization

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6.3.4 Emulsion

Developed at Goodyear Tire and Rubber Company in the 1920s, emulsion polymerization resembles suspension polymerization in that water is used as a dispersing medium and heat transfer is very efficient; but there the similarity ends.²¹⁻²³ Monomer is dispersed in the aqueous phase by an emulsifying agent such as a soap or detergent. Initiator radicals, usually of the redox type, are generated in the aqueous phase and diffuse into soap micelles swollen with monomer molecules. As monomer is used up in the polymerization reaction, more monomer migrates into the micelles to continue the reaction. Termination of polymerization occurs by radical combination when a new radical diffuses into the micelle. Because only one radical is present in the micelle prior to termination, extremely high molecular weights are obtainable, generally too high to be of practical value unless compounds called *chain transfer agents* are added that control the degree of polymerization. (How chain transfer agents work is discussed later in the chapter.) The overall process is complex, with reaction kinetics differing significantly from that of bulk or solution processes.

Emulsion polymerization is widely used in industry for large-scale preparations, and is particularly useful for manufacturing water-based (latex) paints or adhesives in which the emulsified product is used directly. Emulsion polymerization is also suitable for preparing tacky polymers because the very small particles are stable and resist agglomeration. Two typical emulsion recipes are given in Table 6.3.

A much less commonly used emulsion technique involves dispersing an aqueous solution of monomer in a nonaqueous phase. This is referred to as an *inverse* or *water-in-oil*.

TABLE 6.3. Typical Emulsion Polymerization Recipes^a

| <i>Ingredient, Conditions</i> | <i>Styrene-Butadiene Copolymer</i> | <i>Polyacrylate Latex</i> |
|-------------------------------|------------------------------------|---------------------------|
| Ingredients (parts by weight) | | |
| Water | 190 | 133 |
| Butadiene | 70 | — |
| Styrene | 30 | — |
| Ethyl acrylate | — | 93 |
| 2-Chloroethyl vinyl ether | — | 5 |
| p-Divinylbenzene | — | 2 |
| Soap | 5 | 3 ^b |
| Potassium persulfate | 0.3 | 1 |
| 1-Dodecanethiol | 0.5 | — |
| Sodium pyrophosphate | — | 0.7 |
| Conditions | | |
| Time | 12 hr | 8 hr |
| Temperature | 50°C | 60°C |
| Yield | 65% | ~100% |

^a Recipe from Cooper.²²^b Sodium lauryl sulfate.

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Polymer Structure and Properties

Polyaddition—the same as step-reaction polymerization without formation of byproducts (e.g., 1.11 or 1.15).

Chain polymerization—the same as chain-reaction polymerization without formation of byproducts (e.g., 1.13).

Condensative chain polymerization—the same as chain-reaction polymerization with the formation of low-molar-mass byproducts (e.g., 1.16).

Because the IUPAC classifications have yet to be widely accepted, we shall continue to use the more familiar step-reaction (or step-growth) and chain-reaction (or chain-growth) terminology.

1.7 Nomenclature

Polymer nomenclature is complicated for a variety of reasons. First, most polymer names are based on names of the corresponding monomers, and although this source-based system is widely accepted, one frequently encounters variations in format. Second, although the Macromolecular Nomenclature Commission of the IUPAC has grappled valiantly with the complexities of polymer structure and has proposed perfectly logical rules,²⁷ the IUPAC system is not widely used except in reference works. Third, some polymer structures are so complex, particularly where branching or crosslinking is involved, that naming them defies all but the most persistent of nomenclature purists. And finally, polymer science has some fairly sharply defined boundaries; rubber chemists, for example, employ terminology that might be unintelligible to a plastics or textiles chemist. All this takes on added significance in this age of computer-based information storage and retrieval, where a standardized set of abbreviations is a necessity.^{28,29} Given the magnitude of the problem, therefore, we will attempt in this section to clarify the most generally accepted terminology.

As should be apparent from the previous sections, polymer types, or families, are named according to the functional group present in the repeating unit, with the prefix *poly*: polyesters, polyamides, polyethers, and so on. Polyamides are unusual in that they are also called *nylons*, a term that originated as a trade name but then evolved over the years into general use. If more than one functional group is present, the polymer is named accordingly, for example, polyetherimide.

Where polymer structure is complex and not easily definable, the family is usually named for the monomers employed, as with phenol-formaldehyde polymers. Part III of this book discusses a variety of polymers according to the family classification. Polymers derived from monomers containing carbon-carbon double bonds are often referred to as *vinyl polymers*, although it would be more correct to reserve that term for monomers containing the vinyl group, $\text{CH}_2=\text{CH}-$, such as vinyl chloride, $\text{CH}_2=\text{CHCl}$, or acrylonitrile, $\text{CH}_2=\text{CHCN}$. The term *vinylidene* is used with 1,1-disubstituted ethylenes, for example, vinylidene chloride, $\text{CH}_2=\text{CCl}_2$. Polymers derived from simple alkenes such as ethylene or propylene are often called *polyolefins*. For the sake of convenience, we shall refer to all polymers prepared by chain-reaction polymerization of alkanyl monomers as *vinyl polymers*.

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Attachment #2: S.E. Lobo, Jr., et. al., "Lignin," in Encyclopedia of Polymer Science and Technology, John Wiley & Sons, 2002

<http://www.mrw.interscience.wiley.com/emrw/9780471440260/epst/article/pst179/current/ht.htm>

Encyclopedia of Polymer Science and Technology
Lignin

Standard Article

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2. Structure and Reactions

The structural building blocks of lignin are linked by carbon–carbon and ether bonds (7, 8). Units that are trifunctionally linked to adjacent units represent branching sites which give rise to the network structure characteristic of lignin (see Figs. 1 and 2). Thus lignin consists of complex and diverse structures, including in softwood lignin an eight-member ring configuration (dibenzodioxocin) (11). The types and frequencies of several prominent interunitary lignin linkages are summarized in Table 1.

2.7. Substitution Reactions on Side Chains

Because the benzyl carbon is the most reactive site on the propanoid side chain, many substitution reactions occur at this position. Typically, substitution reactions occur by attack of a nucleophilic reagent on a benzyl carbon present in the form of a carbonium ion or a methine group in a quinonemethide structure. In reversal of the ether cleavage reactions described, benzyl alcohols and ethers may be transformed to alkyl or aryl ethers by acid-catalyzed etherifications or transesterifications with alcohol or phenol. The conversion of a benzyl alcohol or ether to a sulfonic acid group is among the most important side-chain modification reactions because it is essential for the solubilization of lignin in the sulfite pulping process (21).

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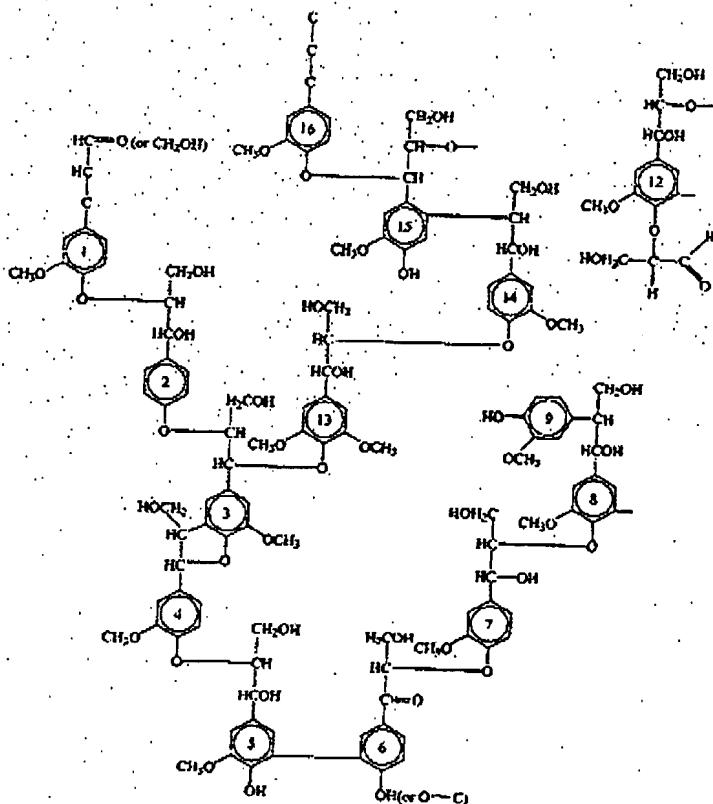
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Lignin

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Figure 1. Structural model of spruce lignin (8).



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